USEFUL FOR UNIVERSITY EXAMS, GATE, NET AND OTHER CS EXAMS

# DATABASE MANAGEMENT SYSTEM

THREE SCHEMA ARCHITECTURE WITH MAPPING EXAMPLE IN DETAIL

PROPER NOTES IN PPT FORM

PART -2

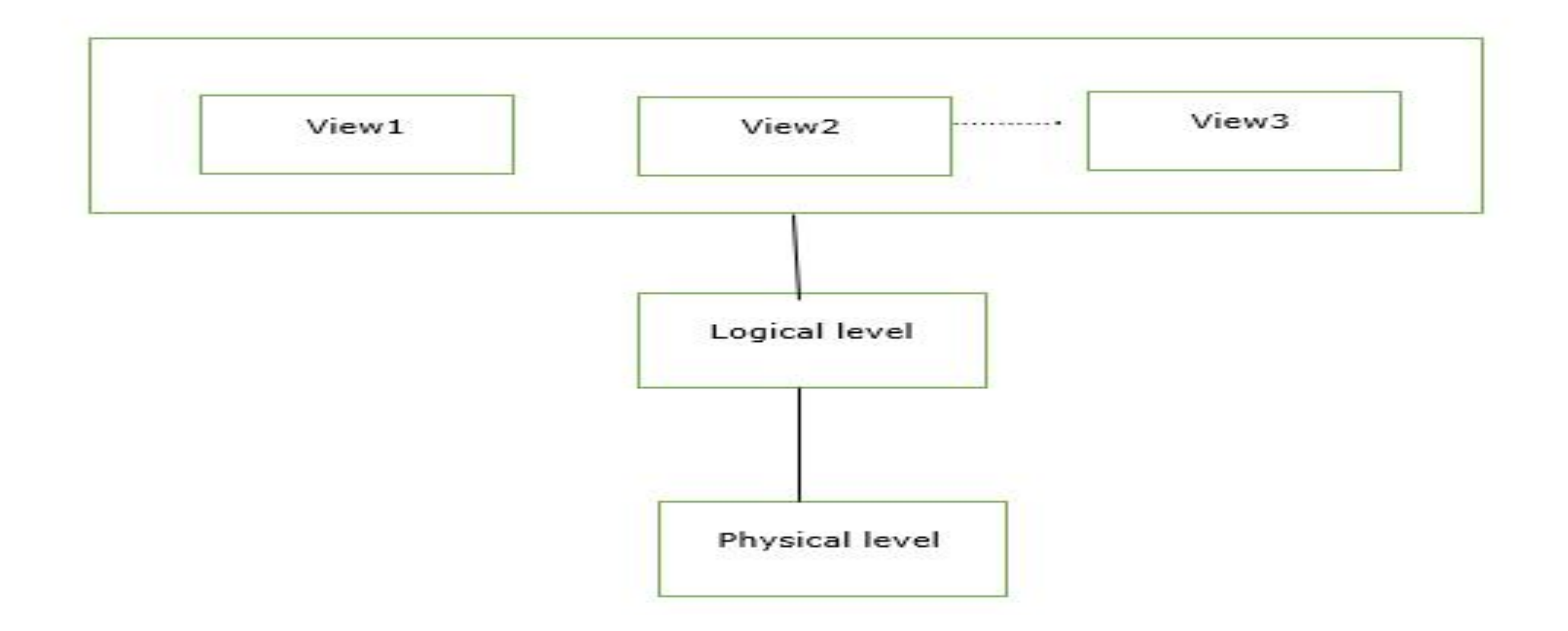


# SCHEMAS AND INSTANCES

- It is basically a skeleton structure that represent the logical view of the entire database.
- It defines how the data is organized and how the relation among them are associated.
- It formulates all the constraints that are to be applied on the data.
- It does not show the data of the database.
- Database schema refers to the format and layout of the database in which the data will be stored.
- It defines the structure of what type of data and how it will be stored.

# SCHEMA PICTORIAL REPRESENTATIONA

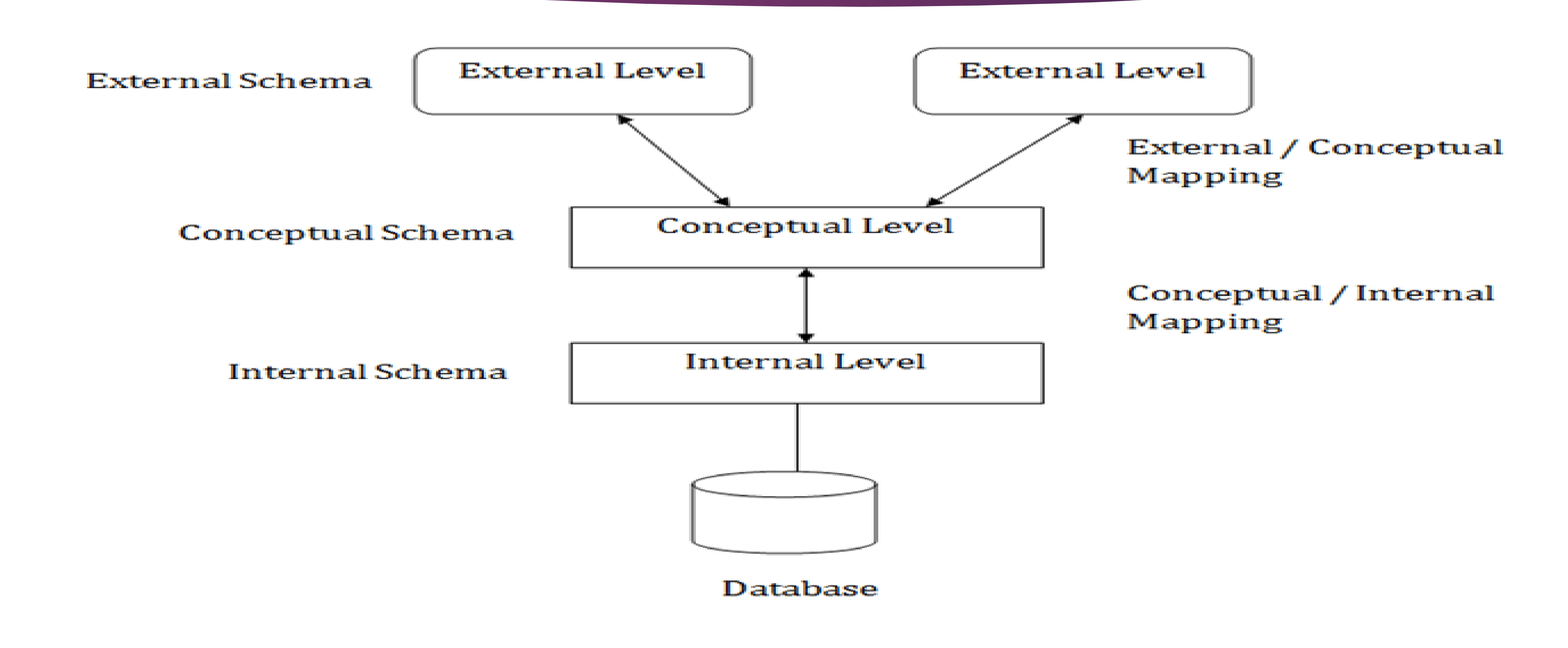
- The schema is pictorially represented as follows –



# THREE SCHEMA ARCHITECTURE OF DBMS

- The three schema architecture describes how the data is represented or viewed by the user in the database.
- The three **schema architecture** divides the database into three-level to create a separation between the physical database and the user application.
- In simple words, this architecture hides the details of physical storage from the user.
- The database administrator (DBA) should be able to change the structure of database storage without affecting the user's view.

# THREE SCHEMA ARCHITECTURE OF DBMS



# INTERNAL OR PHYSICAL LEVEL

- This is the lowest level of database abstraction. It describes how the data is actually stored in the database and provides methods to access data from the database.
- The internal level has an internal schema which describes the physical storage structure of the database.
- The interface between the conceptual schema and the internal schema identifies how an element in the conceptual schema is stored and how it may be accessed.
- If there is any change in the internal or physical schema, it needs to be addressed to the interface between the conceptual and internal schema. But there is no need to change in the interface of a conceptual and external schema.
- It means that the changes in physical storage devices such as hard disks, and the files organized on storage devices, are transparent to application programs and users.

# INTERNAL OR PHYSICAL LEVEL

- It basically focuses on the internal structure such as encryption, decryption techniques, storage structures like B-Trees, Hashing, Indexing, Optimization techniques etc.

Internal view

| STORED_EMPLOYEE record length 60 | | |
|---|---|---|
| Empno | : | 4 decimal offset 0 unique |
| Ename | : | String length 15 offset 4 |
| Salary | : | 8,2 decimal offset 19 |
| Deptno | : | 4 decimal offset 27 |
| Post | : | string length 15 offset 31 |

# CONCEPTUAL LEVEL

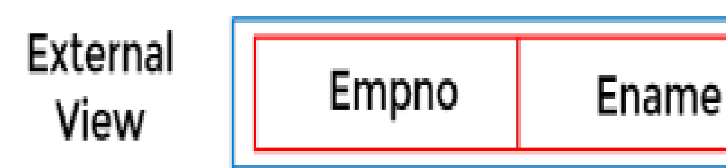
- The conceptual level describes the structure of the whole database.
- This level acts as a middle layer between the physical storage and user view.
- It explains what data to be stored in the database, what relationship exists among those data, and what the datatypes are.
- There is only one conceptual schema per database.
- Database administrator and the programmers work at this level.
- This level does not provide any access or storage details but concentrates on the relational model of the database.
- The conceptual schema also includes features that specify the checks to retain integrity and consistency.

Global view

| EMPLOYEE | | |
|---|---|---|
| Empno | : | Integer(4) Key |
| Ename | : | String(15) |
| Salary | : | String (8) |
| Deptno | : | Integer(4) |
| Post | : | String (15) |

# 3. EXTERNAL OR VIEW LEVEL

- This is the highest level of database abstraction.
- It is also known as View schema or Sub schema.
- External or view level describes the actual view of data that is relevant to the particular user.
- This level also provides different views of the same database for a specific user or a group of users.
- An external view provides a powerful and flexible security mechanism by hiding the parts of the database from a particular user.




| Empno | Ename | Salary | DeptNo |
|---|---|---|---|

# MAPPING BETWEEN VIEWS

- The three levels of DBMS architecture don't exist independently of each other.
- DBMS is responsible for correspondence between the three types of schema. This correspondence is called Mapping.

**There are basically two types of mapping in the database architecture:**

- Conceptual/ Internal Mapping
- External / Conceptual Mapping

# Conceptual/ Internal Mapping

- The Conceptual/ Internal Mapping lies between the conceptual level and the internal level.
- Its role is to define the correspondence between the records and fields of the conceptual level and files and data structures of the internal level.
- For eg. – Assume a student database consisting of conceptual schema as:

  Stu_Id : Integer(5) PRIMARY KEY

  Stu_Name : Varchar(15)

If due to some reason the size of Stu_Name field is changed from 15 to 30 then it will affect only the Internal Level and not the External Level. This flexibility is due to mapping between Conceptual and Internal Level.

# External/ Conceptual Mapping

- The external/Conceptual Mapping lies between the external level and the Conceptual level.
- Its role is to define the correspondence between a particular external and the conceptual view.
- For eg: Consider a Employee Database with following fields:

  Emp_Id : Integer(5)

  Emp_Name : Varchar(50)

  Emp_Salary : Float(10)

If at any point the user wants to see the name and salary of employees having salary greater than 30K so that will be a one possible external schema which will map with the conceptual schema but has nothing to do with the internal schema as the user doesn't needs to know how and where it was stored in the memory.

# EXAMPLE OF MAPPING PROCESS

- Say a user types YouTube.com
- This will be a part of External level.
- Now we know that the external level is mapped with conceptual level. So, once this request arrives at Conceptual level it will be checked if such a website exists or not. If not then an error message will be generated and show to the user at External level as a part of External schema.
- Now since this website exists as there will be checking at conceptual/ logical level, so now the mapping will be done with physical/ internal level.
- At this level the address will be found and he page will be generated for the user and the response will be shown to the user as a part of external schema by going through the conceptual schema.

# Advantages of Three-schema Architecture

- This architecture makes the database abstract. It is used to hide the details of how data is physically stored in a computer system, which makes it easier to use for a user.
- This architecture allows each user to access the same database with a different customized view of data.
- This architecture enables a database admin to change the storage structure of the database without affecting the user currently on the system.

# INSTANCE

- An instance is also called a current state or database state.
- The database schema that defines variables in tables which belong to a specific database, the records of these variables at a particular moment are called the instance of the database.
- Every time we can insert, modify, or delete the value of a data item in a record. One state of data can change into another state and accordingly the I stance will change.
- Content of database at a point of time is called instance or database state.
- There are three types of states present in database −

**Empty state**: When ever a new database is defined.

**Initial state**: first time data is loaded in database.

**Current state**: the present operation is applied to database.

# INSTANCE EXAMPLE OF STUDENT DB

| Std ID | Name | City |
|---|---|---|
| 100 | Lucky | Hyderabad |
| 101 | Pinky | Delhi |
| 102 | Bob | Hyderabad |

# THANK YOU

